High incidence of rickets in children with wheezy bronchitis in a developing country[1]

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Summary: The incidence of rickets in 100 Iraqi infants with wheezy bronchitis (24%) exceeded by two and a half times that found in age-matched controls (9%), and by ten times when only those with severe rickets were considered. The reason for this is not entirely clear, but could be related to the fact that the infants with wheezy bronchitis weighed more and therefore had grown faster than the control group. This itself could be related to the higher incidence of breastfeeding in the infants with wheezy bronchitis. We wish to stress the importance of screening for rickets, particularly in those with wheezy bronchitis.

Introduction

Rickets is frequently seen in tropical and subtropical areas (Jelliffe & Paget Stanfield 1978), and an incidence of 15% has been reported from Iran (Salmpour 1975). In Iraq, a large proportion of cases escape detection because signs of the disease are easily overlooked, particularly during infancy, and routine examination of healthy children is still an uncommon practice.

Because of our impression that rickets was common among children with wheezy bronchitis, a study to investigate this possible association was carried out at the Al-Thawrah Children's Hospital. Al-Thawrah is among the poorest areas of the city of Baghdad.

Methods

One hundred consecutive inpatient children with wheezy bronchitis (Group 1), aged 3–12 months, were screened for evidence of rickets clinically (detection of craniotabes), radiologically (wrist X-ray) and biochemically (serum alkaline phosphatase: AP). Simultaneously, 100 age-matched children were selected randomly from the vaccination clinic attached to the hospital to act as controls (Group II). They underwent the same examinations and investigations as Group 1. None of the children in Group II had had previous wheezy episodes.

The diagnosis of wheezy bronchitis was made according to well established criteria (Sibbald *et al.* 1980). Radiological evidence of rickets was interpreted as either mild, moderate or severe (Caffey 1972). An alkaline phosphatase above 25 King-Armstrong units was considered to be abnormal (Richard *et al.* 1968); it is acknowledged that AP elevation is not specific for bone disease, but none of the children were found to have clinical evidence of hepatic disease. The weights of the children were plotted on simple international growth charts showing 50th and 3rd centile only (Morley 1977).

Results

The age distribution and the number of infants with rickets in both groups are shown in Table 1. Radiological evidence of rickets was found in 24 infants with wheezy bronchitis (Group I) and in 9 controls (Group II). The results of the three screening methods are shown in Table 2. The incidence of radiologically-proven rickets in Group I was over two and a half times that

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Table 1. Age distribution and rickets cases in infants with wheezy bronchitis (Group I) and controls (Group II)

	Group I		Group II	
Age (months)	No.	No. with rickets	No.	No. with rickets
3–4	14	3	14	4
5–6	33	8	33	2
7–8	25	9	25	3
9–10	14	2	14	–
11–12	14	2	14	–
Total	100	24	100	9

Table 2. Results of examinations and investigations

	Group I ($n=100$)	Group II ($n=100$)	Significance
Craniotabes	31	18	$P<0.01$
High AP (>25 KA units)	34	20	$P<0.01$
Radiological evidence of rickets:			
Mild	9	8	$P<0.01$
Moderate	5	–	
Severe	10	1	

Table 3. Method of feeding and weights of infants

	Group I ($n=100$)		Group II ($n=100$)	
	No.	No. with rickets	No.	No. with rickets
Bottle-fed	18	3	44	2
Breastfed	82	21	56	7
Weights:				
Above 50th centile	31		11	
Above 3rd centile	64		56	
Below 3rd centile	5		33	

in Group II, a statistically significant difference ($P<0.01$); and when only severe rickets was considered the difference between the two groups was even greater ($P<0.001$).

Feeding practices differed between the two groups: breastfeeding was more common amongst infants in Group I, who were also found to be heavier (Table 3). The milk formulae used for those who were bottle-fed contained the usual vitamin supplement.

Discussion

In a community where young infants are not exposed to sunlight because of fear of catching cold, getting suntanned or because of ignorance of its benefits, and where vitamin D prophylaxis is not known, a high incidence of rickets can be expected. Our results confirmed this in that 9% of Group II children (controls) had radiological evidence of rickets and 20% of this group had a raised AP and were therefore in the stage preceding the onset of radiological abnormalities (Caffey 1972). Craniotabes occurred in a number of infants without X-ray evidence of rickets. Although craniotabes has been found to be an early sign in infantile rickets (Park & Jelliffe 1962), our findings support the recent report that there is a lack of correlation between the presence of craniotabes and any other sign of rickets (Pettifor *et al.* 1980).

It is possible that the majority of these young children with rickets, particularly the mild cases, will avoid permanent bone deformities if exposed more to sunlight.

The higher overall incidence of rickets in Group I could be explained by the fact that these children weighed more (Table 3) and therefore grew faster than the control group, although both groups came from the same socioeconomic background. This increased weight is possibly due to a higher incidence of breastfeeding in Group I, although the difference in the incidence of rickets in breastfed infants in the two groups is, as expected, insignificant (21 : 82 versus 7 : 56). There is no obvious explanation for the highly significant difference between the groups in the incidence of severe rickets, but it is possible that many children with wheezy bronchitis are kept indoors more than the non-wheezers because of their likely recurrent illness. The role of insufficient exposure to sunlight as the principal factor in causing rickets has been recently stressed (Lovinger 1980).

Breastfed infants in such a poor community commonly attain a weight above the 50th centile mainly because of the immune properties of breast milk (Cunningham 1977, Welsh & May 1979) which protects them from severe infections and malnutrition. Supplementing the feeds with cheap starch products, such as biscuits, is a common practice resulting in infants being overweight and plump, and is commonly seen in children with wheezy bronchitis.

A controlled study of respiratory infections showed that obese infants had a significantly higher number of infections compared with controls of average weight (Tracey & Harper 1971). Obesity can lead to hypoventilation of the lungs (Vaughan *et al.* 1979), causing possible depression of coughing and clearing of secretions from the respiratory tract (Tracey & Harper 1971). Furthermore, children from poor communities in tropical and subtropical areas commonly have an overall deficiency of nutrients, including several vitamins and minerals (Jelliffe & Paget Stanfield 1978). It is possible that an associated vitamin A deficiency, causing changes in the bronchopulmonary epithelium from mucus secretion to keratinization, leads to an increased incidence of respiratory infection (Goodman *et al.* 1980); but clinical manifestations due to vitamin A deficiency have not been seen in our hospital, serving a total child population of about one million, possibly because of an adequate dietary intake of fresh fruits and vegetables which grow locally. Middle East countries are not among those countries with a high incidence of vitamin A deficiency (Jelliffe & Paget Stanfield 1978).

Given the social habits mentioned above, an above average weight in infants with wheezy bronchitis would seem to predispose them to the development of rickets.

Infants who are below the 3rd centile (usually nutritionally deficient from artificial feeding) are prone to severe infections (Chandra 1974 *a,b*) such as bronchopneumonia. In a study of bottle-fed infants in the same community (El-Radhi *et al.* 1980) we found that only 40% of the mothers reconstituted the bottle feed correctly and that over 50% of these infants were below the 3rd centile. However, in clinical practice wheezy bronchitis rarely affects such underweight children.

It is concluded that an association between wheezy bronchitis and rickets seems to exist in infants who are more likely to have optimal weights due to breastfeeding often supplemented with starch products. Socioeconomic factors may also play a role. This seems to contrast with reports of a decreased incidence of respiratory infections among children fed on breast milk in developed countries (Cunningham 1977, Downham *et al.* 1976, Mellander *et al.* 1979). A study is needed to determine whether vitamin D administration can reduce the incidence of wheezy bronchitis in areas where rickets is prevalent.

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References

Caffey J (1972) Pediatric X-Diagnosis. 6th edn. Yearbook Medical, Chicago; p 1222

Chandra R K (1974*a*) *Lancet* ii, 1393

Chandra R K (1974*b*) Progress in Immunology II, vol 4. Academic Press, London; p 355–358

Cunningham A S (1977) *Journal of Pediatrics* **90,** 726

Downham M A P S, Scott R, Sim D G, Webb J K G & Gardner P S (1976) *British Medical Journal* iii, 274
El-Radhi A S, Wasfi M S & Majeed M (1980) *Saudi Medical Journal* **2,** 203
Goodman A G, Goodman L S & Gilman A *ed* (1980) The Pharmacological Basis of Therapeutics. 6th edn. Macmillan, New York; p 1586
Jelliffe D B & Paget Stanfield J (1978) Diseases of Children in the Subtropics and Tropics. 3rd edn. Edward Arnold, London; p 239
Lovinger R D (1980) *Pediatrics* **66,** 3
Mellander O, Vahlquist B & Melbin T (1979) *Acta paediatrica (Uppsala)*, Suppl 116; p 19
Morley D (1977) *Archives of Disease in Childhood* **52,** 395
Park E A & Jelliffe N (1962) Vitamin D and Rickets, Clinical Nutrition. 2nd edn. Harper, New York; p 506
Pettifor J M, Isdale J M, Sahakian J & Hansen J D L (1980) *Archives of Disease in Childhood* **55,** 155
Richard I D G, Sweet E M & Arneil G C (1968) *Lancet* i, 803
Salmpour R (1975) *Archives of Disease in Childhood* **50,** 63
Sibbald B, Horn M E C & Gregg I (1980) *Archives of Disease in Childhood* **55,** 354
Tracey V V, De N C & Harper J R (1971) *British Medical Journal* i, 16
Vaughan V C, McKay R J & Behrman R E (1979) Nelson Textbook of Paediatrics. 11th edn. Saunders, Philadelphia; p 1248
Welsh J K & May J T (1979) *Journal of Pediatrics* **94,** 1